IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application of

Applicant : Paul D. Shirley
Serial No. : 11/773,968
Filed : February 6, 2004
Title : **DEVICE AND METHOD FOR FORMING AN IMPROVED RESIST LAYER**
Docket : MIO 0112 PA
Examiner : Laura Edwards
Art Unit : 1792
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P.O. Box 1450
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Alexandria, Virginia 22313-1450

Sir:

CORRECTED APPEAL BRIEF

This Appeal Brief is in response to a Notification of Non-Compliant Appeal Brief mailed on October 30, 2009. In the Notification, the Patent Appeals Specialist indicated that the Appeal Brief filed on October 12, 2009 was defective for failing to (1) contain a statement of the status of a response filed after the final rejection, (2) contain a concise explanation of the subject matter defined in each of the independent claims and (3) contain a correct copy of the appealed claims in an appendix.

In response, the present Appeal Brief includes corrections made to the following sections entitled Status of Amendments, Summary of the Claimed Subject Matter and Claim Appendix. Otherwise, the presently amended Appeal Brief is substantially identical to the one filed on October 12, 2009. The Patent Appeals Specialist indicated that resubmission of the entire brief is not required; nevertheless, in the interest of presenting a corrected Appeal Brief in complete form, the Applicants submit the brief *in toto*.

Real Party In Interest

The real party in interest is the Assignee, Micron Technology, Inc., a corporation of the State of Idaho, by assignment from the named inventors, which assignment has been recorded at the United States Patent & Trademark Office on May 17, 2004 at Reel 015336, Frame 0833.

Related Appeals and Interferences

None.

Status of Claims

Claims 1 through 20 stand rejected in the present application and are the subject of the present appeal. Claims 21 through 37 were withdrawn pursuant to a restriction requirement mailed on October 25, 2007. A correct copy of the appealed claims are set forth in the Appendix.

Status of Amendments

In a response filed on July 13, 2009, the Applicants amended the independent claims to more particularly recite the nature of the invention. The Examiner indicated in her July 16, 2009 Advisory Action that these amendments would not be entered on the ground that they would raise new issues that would require additional consideration, search or both, and that they did not place the application in better form for appeal. The Appendix includes only the claims in their as-entered form (i.e., not including the changes made in the July 13, 2009 response). In the event that the Board concludes that the claims in their non-entered form are needed in order to better identify the patentably distinguishing features argued herein, the Applicants are prepared to have such claims

entered. Otherwise, the as-entered claims from the January 26, 2009 response are believed to be sufficient in and of themselves to support the arguments made below.

With the exception of the amendments discussed in the previous paragraph that were made in the Applicants' after-final response mailed on June 18, 2009, all previous amendments have been entered. The Appellants have not filed any response or amendment subsequent to the July 16, 2009 Advisory Action.

Summary of the Claimed Subject Matter

Claims 1, 5, 14, 16 and 20 are the independent claims, of which claim 1 recites a device for the application of resist onto a substrate, claims 5 and 14 recite a device for depositing a solution onto a substrate and claims 16 and 20 recite a resist application device. A concise explanation of the subject matter defined in the independent claims is set forth for each *in seriatim.*

Independent Claim 1

In independent claim 1, a resist application device **1** (as depicted in FIG. 5) is used to vary the placement of air, inert gas or other control fluid **J** onto a layer of resist **R** that is deposited on a substrate in order to promote a substantially uniform thickness in the deposited layer, as discussed at page 2, lines 12 through 15 of the original specification. A rotatable support **40** holds the substrate (for example, a wafer), while a resist supply **20** is used to deposit resist **R** onto the substrate. A control fluid supply **80** provides a localized change in a rate of evaporation of the deposited resist **R**, and can use a fan (as shown in FIG. 5) or related pressure source to introduce the control fluid **J** through a conduit **82** and discharge orifice **84** so that the control fluid **J** is imparted onto a localized portion of the deposited resist **R**. A controller **110** is used to provide control of at least the control fluid supply **80**. These features combine to reduce the likelihood of local thickness changes in the resist **R**, and are discussed with particularity in the original specification at (among other places)

page 2, lines 7 through 20, and again at page 9, line 19 through page 12, line 24.

Independent Claim 5

Independent claim 5 recites a solution-depositing device **1** that includes a fluid supply **80** configured to provide a flow of control fluid **J** to a portion of a substrate (shown in FIG. 5 as wafer **W** and discussed at lines 4 through 7 of page 3 of the original specification). In this way, the control fluid **J** can be applied to portions of the deposited resist **R** to effect a reduction in resist layer thickness variation (examples of which are shown in FIGS. 1 through 4) that is accomplished through local modification of solvent evaporation rate, where the solvent is used in conjunction with the resist **R**. The device includes a controller **110** with detectors **75**, **85** and **95**, as well as a feedback apparatus (in the form of a thickness monitor **120**) to correct deviations between a sensed parameter (such as deposited resist thickness) and a predetermined reference thickness. These features are discussed with particularity in the original specification at page 2, line 22 through page 4, line 10, and again at page 10, lines 2 through 19, and further at lines 30 through 31.

Independent Claim 14

Independent claim 14 recites a device **1** for depositing solvent-based coating in a manner generally similar to claim 5, further reciting a rotatable wafer chuck **40** (shown in FIG. 5) and a housing **10**. The housing **10** contributes to a controllable environment so that a solvent-free gaseous control fluid can be imparted to a portion of a deposited resist layer to produce a local change in evaporation rate. These features are discussed with particularity in the original specification at (among other places) page 4, lines 12 through 30, and again at page 9, line19 through page 10, line 31.

Independent Claim 16

Independent claim 16 recites a resist application device **1** with a rotatable wafer chuck **40**, a layer-depositing dispenser **30**, a housing **10**, a control fluid supply **80** that imparts a substantially

solvent-free control fluid **J**, and a controller **110** that cooperates with the control fluid supply **80** to promote a substantially uniform thickness in a deposited layer of resist **R**. This apparatus is shown in FIG. 5, and is discussed with particularity in the original specification at page 5, lines 1 through 13, and again at page 10, lines 2 through 19, and further at lines 30 through 31.

Independent Claim 20

Independent claim 20 recites a resist application device **1** with a rotatable wafer chuck **40**, a resist-depositing dispenser **30**, a housing **10**, an airflow supply **80** that reduces a localized change in evaporation rate of the deposited layer of resist **R**, and a controller **110** to vary the placement of the airflow **J**. This device **1** is shown in FIG. 5, and is discussed with particularity in the original specification at page 5, lines 15 through page 6, line 3, and again at page 11, line 15 through page 12, line 24.

Grounds of Rejection to be Reviewed on Appeal

Claims 1, 2, 16 and 18 through 20 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,939,139 to Fujimoto (hereinafter Fujimoto).

Claims 1 through 7, 10, 12 through 18 and 20 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 5,919,520 to Tateyama et al. (hereinafter Tateyama).

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimoto in view of Tateyama.

Claims 8 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tateyama in view of US Published Application 2002/0176936 to Matsuyama (hereinafter Matsuyama).

Arguments

I. The rejection of claims 1, 2, 16 and 18 through 20 (claim 1 representative) under 35 USC §102(b) over Fujimoto is improper, as Fujimoto does not teach the claimed device for providing a control fluid onto a deposited resist to effect a local change in a rate of evaporation of the deposited resist as the Examiner suggests.

The Examiner takes the position in the latest Office Action that Fujimoto structurally anticipates the instantly claimed invention because it teaches a local change in the evaporation rate of the deposited resist. The emphasis in the independent claims on the localized nature of this control is an important feature of the invention. Specifically, numerous places in the original specification discuss the value of discrete, targeted application of the gaseous control fluid and the effect of such on local control on resist layer thickness uniformity. A particular example of this is noted at page 8, lines 2 through 13, where the Applicant explains that the localized introduction of airflow at discrete locations on the deposited resist layer can be used to (among other things) compensate for differences in airspeed that inherently exist at the periphery of the spinning wafer relative to its center. The local nature of the evaporation rate of the deposited resist, and its meaning when used as a claim interpretation tool is controlled by MPEP 2111, which requires that such claim terms are read in a manner that is consistent with the specification.

By way of contrast, Fujimoto teaches a device and method for removing a coated insulation film *that has been deposited on top of* a resist layer. It is impossible for such a device to effect *any* change in resist layer thickness. As a logical corollary, Fujimoto is silent as to improving the planarization of the resist layer, instead focusing on using a combination of solvent and gas to achieve a separate insulation coating layer removal. Because Fujimoto doesn't even address the same type of layer (focusing on solvent-sensitive polyimides or the like instead of the radiation-sensitive photoresist discussed in the claims), its use as an anticipatory rejection is no longer available, as MPEP 2131 states that for a claim to be anticipated, a single reference must disclose each and every positively recited limitation. In other words, a rejection grounded on anticipation is proper only

where the subject matter claimed is *identically* disclosed or described in a reference. *In re Arkley*, 172 USPQ 524 (CCPA 1972). Since there is no evidence in Fujimoto to teach or suggest a *resist* depositing device or method in a manner as set forth in the claims, the Applicant respectfully submits that the present rejection is defective, and should be withdrawn.

II. The rejection of claims 1 through 7, 10, 12 through 18 and 20 under 35 USC §102(b) over Tateyama is improper, as Tateyama does not teach the claimed device to improve the uniform thickness of the deposited resist layer as the Examiner suggests.

The Examiner indicates that the air nozzle of Tateyama is capable of usage without solvent, and as such, makes it an anticipatory reference. Nevertheless, the system of Tateyama neither teaches nor suggests a localized impingement of the control fluid on a portion of the deposited resist layer in a manner that produces a local change in evaporation rate of the deposited layer to produce a substantially uniform deposited resist layer. Instead, column 8, lines 45 through 52 of Tateyama states that the air coming out of nozzle **80** is deposited "along the entire length of moveable beam **20**" and that this configuration can "spout air onto the entire top surface of the wafer". Such a device is not capable of the claimed localized performance. For the Examiner to hold that the discharge of control fluid over the entire length of the beam **20** of Tateyama satisfies the claimed requirement used to produce a portioned, local control of the deposited layer thickness would be to destroy the plain meaning of such requirements, and therefore impermissible under MPEP 2111. As such, Tateyama is not a proper anticipatory reference to any of independent claims 1, 14, 16 or 20.

III. The rejection of claims 3 and 4 under 35 USC §103(a) over Fujimoto in view of Tateyama is improper, as the combination does not teach the claimed device for a plurality of moveable fluid dispensing nozzles capable of depositing a control fluid onto a portion of a deposited resist layer to produce a local change in deposited layer evaporation rate as the Examiner suggests.

The Examiner candidly admits in the May 12, 2009 Office Action that Fujimoto does not disclose a plurality of nozzles. Furthermore, as discussed above in Sections I and II, there is nothing

in Fujimoto or Tateyama, taken either together or separately, to teach or suggest the localized nature of the solvent-free gaseous control fluid deposition or the concomitant layer thickness uniformity in the deposited resist layer. Thus, even with using Tateyama to overcome the immediate claim 3 and 4 deficiencies of Fujimoto, the continued failure of the combination to meet the underlying requirement in independent claim 1 (from which claims 3 and 4 depend) makes it insufficient to establish the *prima facie* case, as not every claimed feature under MPEP 2143.03 is present in the combination. As a matter of law, this rejection must be reversed by this Board.

IV. The rejection of claims 8 and 9 under 35 USC §103(a) over Tateyama in view of Matsuyama is improper, as Tateyama does not teach the claimed device for a humidity and temperature supply as a way to effect a local change in evaporation rate in the manner the Examiner suggests.

Dependent claims 8 and 9 recite respectively that humidity and temperature changes, while the specification states that these features can be used to promote the needed localized changes in thickness of the deposited resist layer. Nowhere in the combination of Tateyama and Matsuyama does the claimed recitation of using the temperature and humidity control in conjunction with the remaining limitations from independent claim 5 (from which claims 8 and 9 depend) get taught or suggested. In fact, the only place where such a teaching occurs is in the claims and original specification of the Applicant's application, and it is well-established that one is not allowed to pick and choose among individual parts of assorted prior art references "as a mosaic to recreate a facsimile of the claimed invention". *W.L. Gore & Assoc., Inc. v. Garlock*, 220 USPQ 303, 312 (Fed. Cir. 1983).

In addition to not including the particulars of claims 8 and 9, Matsuyama is defective for failing to teach a control fluid. What the Examiner refers to as the control fluid is in fact a solvent used to improve wettability of the resist layer to be deposited. By confounding the claim term "control fluid", the Examiner deviates from the well-established USPTO practice of interpreting a claim term through recourse to the specification. *Phillips v. AWH Corp.*, 75 USPQ2d 1321, 1327-28

(Fed. Cir. 2005). Given this well-established authority, the Examiner must construe the term "control fluid" and its related supply in the manner set forth in the specification, specifically as a gaseous fluid that through localized impingement onto the surface of an already-deposited resist layer changes the rate of evaporation of the deposited resist through manipulation of an already-deposited liquid solvent.

With such understanding of the claim term, there is no similarity between the control fluid of the independent claims and the solvent of Matsuyama. MPEP 2173.05(a) notes that when "the specification states the meaning that a term in the claim is intended to have, the claim is examined using that meaning, in order to achieve a complete exploration of the applicant's invention and its relation to the prior art." Given this well-established practice, the Examiner must construe the term "control fluid" and its related supply in the manner set forth in the specification as a fluid that through impingement onto the surface of an already-deposited resist layer changes how quickly a solvent layer added thereto evaporates, which in turn changes the rate of evaporation of the deposited resist. By failing to appreciate this particular attribute, the Examiner combines two disparate references in a manner not sufficient to produce a *prima facie* case of obviousness.

Conclusion

For all of the above reasons, the Applicant submits that the Examiner's rejection of the claims identified above is improper, and should be **REVERSED**.

Respectfully submitted,

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Claim Appendix

The claims below are shown in their presently entered form. As indicated above, amendments made to these claims in a July 13, 2009 response have not been entered.

1. (Previously Presented) A device for depositing resist onto a substrate, said device comprising:

a rotatable substrate support comprising a first surface onto which a layer of solvent-containing resist may be deposited;

a resist dispenser fluidly adjacent said first surface for depositing said layer on said first surface;

a control fluid supply configured to impart a substantially solvent-free gaseous control fluid onto a portion of said deposited layer such that said gaseous control fluid emanating from said supply effects a local change in evaporation rate of said deposited layer; and

a controller configured to vary the placement of said gaseous control fluid onto said deposited layer of resist to effect a substantially uniform thickness layer thereof.

2. (Original) A device according to claim 1, wherein said control fluid supply comprises a fluid dispensing nozzle that is moveable relative to said rotatable substrate support.

3. (Original) A device according to claim 1, wherein said control fluid supply comprises a plurality of fluid dispensing nozzles.

4. (Original) A device according to claim 3, wherein said plurality of fluid dispensing nozzles occupy a substantially fixed location relative to said rotatable substrate support.

5. (Previously Presented) A device for depositing a solution on a substrate, said device

comprising:

a rotatable substrate support comprising a first surface onto which a layer of solvent-containing solution may be deposited;

a solution dispenser fluidly adjacent said first surface for depositing said layer on said first surface;

a fluid supply configured to impart a substantially solvent-free gaseous control fluid onto a portion of said deposited layer such that said gaseous control fluid emanating from said fluid supply effects a local change in evaporation rate of said deposited layer; and

a controller comprising:

at least one detector configured to sense a parameter corresponding to said gaseous control fluid; and

a feedback apparatus responsive to said detector such that upon a deviation between said sensed parameter and a predetermined reference, said controller adjusts said fluid supply to reduce said deviation.

6. (Original) The device of claim 5, wherein said support is a wafer chuck.

7. (Original) The device of claim 6, wherein said fluid supply comprises an airflow supply.

8. (Original) The device of claim 6, further comprising a humidity supply configured to humidify airspace adjacent said wafer chuck.

9. (Original) The device of claim 6, further comprising a temperature supply configured to adjust temperature adjacent said wafer chuck.

10. (Previously Presented) The device of claim 7, wherein said airflow supply is configured to impart airflow onto a predetermined substrate location in a substantially vertically downward

direction.

11. (Original) The device of claim 5, wherein said controller is configured to operate in a plurality of modes comprising a substantially automated mode and a manual mode, the second of which permits said controller to be additionally responsive to an operator input.

12. (Previously Presented) The device of claim 5, wherein a dispensing nozzle coupled to said fluid supply is moveable relative to said first surface such that said gaseous control fluid can be imparted onto different said portions of said deposited solution.

13. (Original) The device of claim 12, wherein said dispensing nozzle and said controller are cooperative such that said dispensing nozzle moves in response to said deviation.

14. (Previously Presented) A device for depositing a solvent-containing solution on a substrate, said device comprising:

a rotatable wafer chuck comprising a first surface onto which a layer of solution may be deposited;

a solution dispenser fluidly adjacent said first surface for depositing said layer on said first surface;

a housing disposed about said wafer chuck such that a substantially controllable environment is formed within said housing;

a fluid supply in fluid communication with said substantially controllable environment, said fluid supply configured to impart a substantially solvent-free gaseous control fluid onto a portion of said deposited layer such that said gaseous control fluid emanating from said fluid supply effects a local change in evaporation rate of said deposited layer; and

a controller comprising:

at least one detector configured to sense a parameter corresponding to said

gaseous control fluid; and

a feedback apparatus responsive to said detector such that upon a deviation between said sensed parameter and a predetermined reference, said controller adjusts said fluid supply to reduce said deviation.

15. (Original) The device of claim 14, further comprising at least one of an exhaust or drain in said substantially controllable environment.

16. (Previously Presented) A resist application device comprising:

a rotatable wafer chuck comprising a first surface onto which a layer of solvent-containing resist may be deposited;

a dispenser configured to deposit said layer onto said first surface;

a housing disposed about said wafer chuck such that a substantially controllable environment is formed within said housing;

a fluid supply fluidly coupled to said substantially controllable environment, said fluid supply configured to impart a substantially solvent-free gaseous control fluid onto a portion of said deposited layer such that said gaseous control fluid emanating from said fluid supply effects a local change in evaporation rate of said layer; and

a controller configured to vary the placement of said gaseous control fluid onto said deposited layer of resist to effect a substantially uniform thickness layer thereof.

17. (Previously Presented) The device of claim 16, further comprising a detector configured to sense a parameter associated with said gaseous control fluid in said substantially controllable environment such that said controller is responsive to said detector such that upon a deviation between said sensed parameter and a corresponding predetermined reference level, said controller adjusts said supply to reduce said deviation.

18. (Previously Presented) The device of claim 16, wherein said gaseous control fluid comprises air.

19. (Previously Presented) The device of claim 16, wherein said gaseous control fluid is a substantially inert gas.

20. (Previously Presented) A resist application device comprising:

a rotatable wafer chuck;

a dispenser configured to deposit a solvent-containing layer of resist onto a generally upper surface of said wafer chuck;

a housing disposed about said wafer chuck such that a substantially controllable environment is formed within said housing;

an airflow supply fluidly coupled to said deposited layer on said generally upper surface such that upon impingement of a substantially solvent-free airflow onto a desired part of said deposited layer, said airflow produces a localized change in evaporation rate of said deposited layer relative to parts of said layer that are not substantially exposed to said impingement; and

a controller configured to vary the placement of said airflow onto said deposited layer-to effect a substantially uniform thickness layer thereof.

21. (Withdrawn) A method of controlling the evaporation of solvent from a deposited resist layer, said method comprising:

depositing resist onto a rotating substrate; and

impinging a control fluid onto a portion of said deposited resist prior to curing of said resist such that said control fluid effects a local change in evaporation rate of said deposited resist.

22. (Withdrawn) The method of claim 21, further comprising:

sensing an evaporation parameter corresponding to said control fluid;

determining whether a deviation exists between said sensed parameter and a predetermined reference amount; and

if said deviation exists, adjusting said parameter to reduce said deviation.

23. (Withdrawn) The method of claim 22, wherein said sensed parameter is a flow rate of said control fluid.

24. (Withdrawn) The method of claim 21, wherein said control fluid comprises air.

25. (Withdrawn) The method of claim 21, including placing a housing around said substrate to form a substantially controllable environment.

26. (Withdrawn) The method of claim 25, including controlling temperature within said substantially controllable environment.

27. (Withdrawn) The method of claim 25, including controlling humidity within said substantially controllable environment.

28. (Withdrawn) The method of claim 22, wherein said adjusting comprises selectively increasing or decreasing said control fluid impingement.

29. (Withdrawn) The method of claim 28, wherein said selective increasing or decreasing comprises moving a dispensing nozzle of said supply of control fluid relative to said substrate.

30. (Withdrawn) A method of depositing a resist onto a substrate, said method comprising:

configuring a device to comprise:

a rotatable substrate support comprising a first surface onto which a layer of said resist may be deposited;

a resist dispenser;

a fluid supply configured to impart a control fluid onto a portion of said resist layer such that said control fluid emanating from said fluid supply effects a local change in evaporation rate of said resist layer; and

a controller configured to vary the placement of said control fluid onto said deposited layer of resist to effect a substantially uniform thickness layer thereof;

placing said substrate on said support;

rotating said substrate;

depositing resist from said dispenser onto said substrate to form said resist layer thereon; and

impinging said control fluid onto a portion of said resist layer to effect said local change in said evaporation rate therefrom.

31. (Withdrawn) The method of claim 30, further comprising:

providing at least one detector configured to sense a parameter corresponding to said fluid supply;

sensing said fluid flow parameter with said detector;

comparing said sensed parameter to a predetermined reference to determining whether a deviation exists between said sensed parameter and said predetermined reference; and

if said deviation exists, adjusting said fluid supply to reduce said deviation.

32. (Withdrawn) The method of claim 31, further comprising providing a feedback apparatus responsive to said detector such that said feedback apparatus performs said adjusting said fluid supply.

33. (Withdrawn) The method of claim 31, wherein said substrate is a semiconductor wafer.

34. (Withdrawn) The method of claim 31, wherein said control fluid comprises air.

35. (Withdrawn) A method of forming a resist layer, said method comprising:

configuring a device to comprise:

a rotatable substrate support;

a resist dispenser;

a fluid supply fluidly adjacent said support, said fluid supply configured to impart a control fluid onto a portion of said resist layer such that said control fluid emanating from said fluid supply effects a local change in evaporation rate of said resist layer; and

a controller comprising:

at least one detector configured to sense a fluid flow parameter corresponding to said fluid supply; and

a feedback apparatus responsive to said detector such that upon a deviation between said sensed parameter and a predetermined reference, said controller adjusts said fluid supply to reduce said deviation;

placing said substrate on said support;

rotating said support and substrate;

depositing resist from said dispenser onto said substrate;

sensing said control fluid parameter;

determining whether a deviation exists between said sensed parameter and said predetermined reference;

if said deviation exists, adjusting said supply to reduce said deviation; and

curing at least a portion of said resist.

36. (Withdrawn) The method of claim 35, wherein said resist is cured by:

subjecting said resist to a first heat treatment;

forming a pattern over said resist to define, upon exposure of said pattern to a source of radiation, a first resist portion and a second resist portion;

exposing said pattern and at least one of said resist portions to said source of radiation;

removing one of said first or second resist portions; and

subjecting the portion of the remaining resist portion to a second heat treatment.

37. (Withdrawn) The method of claim 36, wherein said removing comprises removing the resist portion that was not exposed to said source of radiation during said exposing.

Evidence Appendix

None.

Related Proceedings Appendix

None.